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File Code: 3420 **Date:** December 22, 2008
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Subject: Insect activity in the Chitty Fire Salvage Sale - corrected number of acres in Fire

To: District Ranger, Alpine RD, Apache-Sitgreaves NFs

Monica Boehning requested assistance from the Arizona Zone Forest Health Protection (FHP) in reviewing marking guidelines that were developed for fire-damaged trees in the Chitty Fire Salvage Sale on the Alpine and Clifton RD. We met with Monica and other staff to evaluate marking guidelines and insect activity in the fire area on the October 30, 2008. I describe in this report what insect activity was observed in this area and provide suggestions for crews conducting the marking of trees infested with bark beetles.

Chitty Fire Salvage Sale

The Chitty Fire started by lightning on June 30, 2007 and burned approximately 6,999 acres on the Clifton and Alpine Ranger Districts of the Apache-Sitgreaves National Forests. The fire burned in the Chitty Canyon area adjacent to Highway 191 and Blue Vista Overlook in mixed conifer vegetation, primarily on a steep, southwest aspect. Forest Road 54 at the top of the Mogollon Rim and Highway 191 was used as a suppression burn-out zone that was intentionally lit to stop the advancing wildfire. Vegetation in this area above Mogollon Rim is also mixed conifer, but the terrain is relatively flat. Because ladder fuels were pre-treated in 2007 within the fuel break under the 2006 Chitty Restoration project, most of the overstory and midstory trees burned in the Chitty Fire Salvage Sale area received only moderate to low fire damage. However, trees which initially survived the burnout and/or wildfire may have been weakened enough to attract various insects, such as bark beetles, which are now causing post-burn tree mortality. Objectives of the Chitty

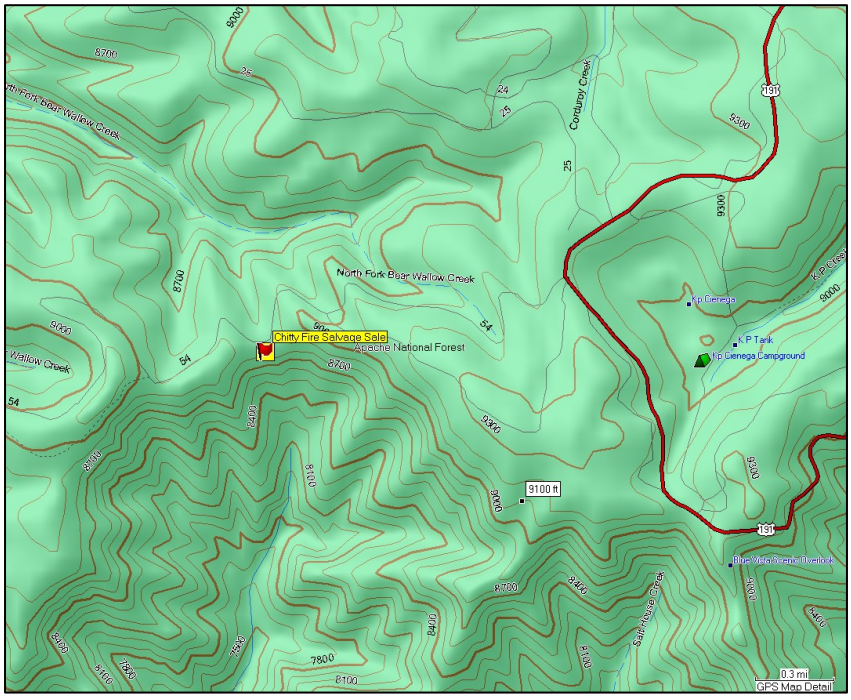

Figure 1. *Location of walkthrough survey for insect activity within the Chitty Fire Salvage Sale.*

Fire Salvage Sale include 1) using marking guidelines to identify those trees facing imminent mortality from fire-damage and insect attacks, 2) salvage trees facing imminent mortality to provide timber volume to local mills and 3) maintain the fuel break area. Managing bark beetle populations is not an objective of the salvage sale as the area to be treated is a very small percentage of the whole area impacted and, therefore, removal of infested trees would not affect populations.

Insect activity in the Chitty Fire Salvage Sale

We conducted a brief walkthrough survey of a portion of the 200 acre Chitty Fire Salvage Sale (***Figure 1***). We observed several large and medium-sized southwestern white pine attacked by mountain pine beetle (*Dendroctonus ponderosae*) and also a few ponderosa pine attacked by roundheaded pine beetle (*D. adjunctus*) on (***Figure 2***). Most of these trees had been fully attacked (i.e., pitch tubes were seen on all sides of the bole from near the base to mid-height), but in some cases there were strip attacks in which only one side of the bole had been infested by bark beetles.

Historically, outbreaks of mountain pine beetle have only occurred on the north rim of the Grand Canyon (Parker 1980), although there are collection records from areas near Flagstaff and in the Chiricahua Mountains in southeast Arizona (Wood 1982). To our knowledge, mountain pine beetle has not been recorded in the White Mountains. Mountain pine beetle has also been recently found on the Pinaleño Mountains on the Coronado National Forest. In addition, this beetle has been having landscape level impacts to lodgepole pine and ponderosa pine forests in the Rocky Mountains and the Black Hills in recent years. Mountain pine beetle typically has one generation per year in Arizona with peak adult emergence and flight occurring in early August (McMillin, unpublished data). All species of native pines can serve as hosts for mountain pine beetle (Furniss and Carolin 1977).

Roundheaded pine beetle outbreaks are sporadic and short-lived in the Southwest (Massey et al. 1977). Attacks can occur on both ponderosa pine and white pines (Wilson 1993), and often occur in combination with other beetles such as western pine beetle (*D. brevicomis*) and engraver beetles (*Ips* species). Their attacks are typically focused on the mid- to lower bole of pines

Figure 2. *Bark beetle activity on pine trees within the Chitty Fire Salvage Sale. Pitch tubes caused by mountain pine beetle attack on southwestern white pine (left). Egg and larval galleries of mountain pine beetle in southwestern white pine (center). Pitch tubes and initial construction of egg galleries by roundheaded pine beetle in a heavily scorched ponderosa pine (right).*

growing in dense stands (Negrón et al. 2000). There is one generation per year with primary flight of beetles occurring in October and a secondary flight in the spring.

Because we did not have time to survey unburned areas adjacent to the Chitty Fire, we could not tell if the mountain pine beetle activity was restricted to fire-damaged trees. Although western pine beetle, red turpentine beetle (*D. valens*) and pine engraver species may be attracted to fire-damaged pine trees (Miller and Patterson 1927, Miller and Keen 1960, Smith 1971, DeMars and Roettgering 1982, Bradley and Tueller 2001, Ganz et al. 2003, McHugh et al. 2003), other species, such as mountain pine beetle, do not seem to be attracted to fire-damaged pine trees (Rasmussen et al. 1996, McHugh et al. 2003).

Recent studies have demonstrated the importance of bark beetles in models of post-fire mortality of ponderosa pine trees (McHugh et al. 2003, Wallin et al. 2003, Sieg et al. 2006, Breece et al. 2008). In general, bark beetle attacks occurred on trees sustaining greater crown damage, with increased probability of bark beetle attack at total crown damage levels above 50% (McHugh et al. 2003). However, trees must have enough green phloem for successful bark beetle attack and brood production (Parker et al. 2006); thus, trees sustaining severe bole damage may not be a viable host.

In addition to observing bark beetle activity within the Chitty Fire Salvage Sale area, we also noticed that several large diameter Douglas-fir trees had very thin upper and mid crowns (***Figure 3***). We did not find any signs of insects that may have caused these thin crowns, and this could be just a stress response of these trees to the fire. However, because insects are generally more active in the late summer/early summer, we will conduct another survey next year to look for insects.

Figure 3. *Douglas-fir trees with thin upper crowns in the Chitty Fire Salvage Sale.*

Review of tree marking guidelines

Overall, the marking guidelines developed for identifying tree facing imminent mortality seem sufficient. Obviously not 100% of the trees predicted to die will in fact do so in the next year; conversely, other trees thought to survive will die due to a variety of reasons. Nonetheless, we feel the guidelines should provide the necessary criteria for meeting objectives of the salvage sale. Based on our discussions in the field, there were a few suggestions for marking crews:

(1) When the marking crew is inspecting trees for pitch tubes, it is important to look over as much of the bole as feasible. Pitch tubes caused by mountain pine beetle and roundheaded pine beetle may not be present at dbh or eye level, and therefore areas higher on the bole should be examined.

(2) As mentioned previously, red turpentine beetle is often attracted to fire-damaged pine trees. Pitch tubes caused by red turpentine beetle occur near the base of trees in low numbers. Attacks

by this beetle will typically not result in tree death as the cambium is not completely girdled (Smith 1971).

(3) Crews should also carefully inspect the boles of fire-damaged trees for abundant amounts of boring dust (frass) caused by bark beetles. Trees that are under stress may not produce pitch tubes when being attacked by bark beetles, and therefore the only initial sign or symptom to identify attacked trees is boring dust. In addition, Douglas-fir trees attacked by Douglas-fir beetle typically will not have any pitch tubes present, but instead may only exhibit a few thin streams of clear pitch near the mid- or upper-bole (Schmitz and Gibson 1996). So again the presence of boring dust is critical in the identification of infested trees. As indicated in the marking guidelines, boring dust must occur in a sufficient amount around the whole circumference of the tree to warrant marking for salvage. Boring dust caused by successful bark beetle attack is fine in texture and rust-colored, and will be found around the base of trees, in bark crevices, and attached to spider webs on bark. Boring dust caused by ambrosia beetles (closely related to bark beetles, but do not directly kill conifers) is very fine in texture and white in color as these beetles bore into the sapwood of trees (Daterman and Overhulser 2002). Ambrosia beetles can infest every commercial conifer species in the West (Daterman and Overhulser 2002), and are frequently seen on white fir trees killed by fire in Arizona (McMillin, personal observations).

If you have any questions regarding our assessment of current bark beetle activity within the recreation sites or my recommendations, please let us know.

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